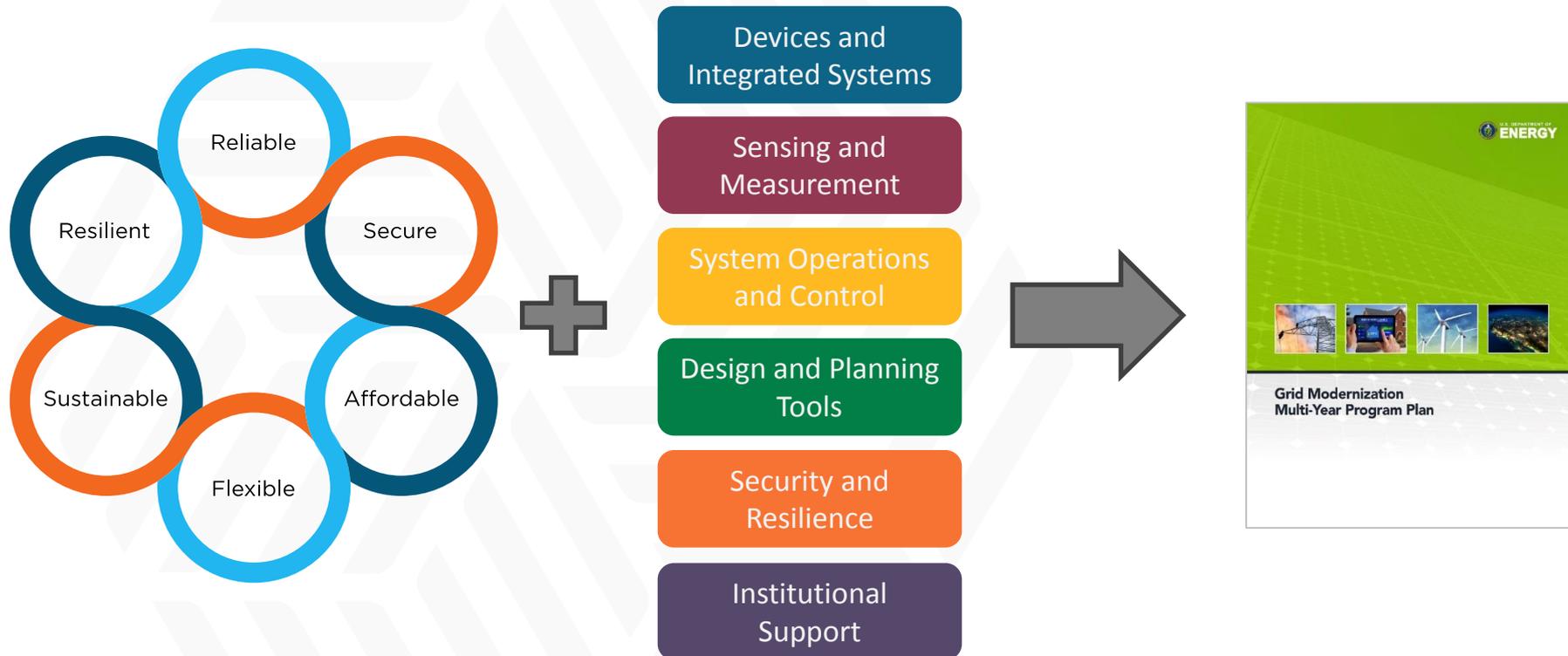


Grid Modernization Initiative (GMI) Briefing for the EAC

BILL PARKS AND KEVIN LYNN

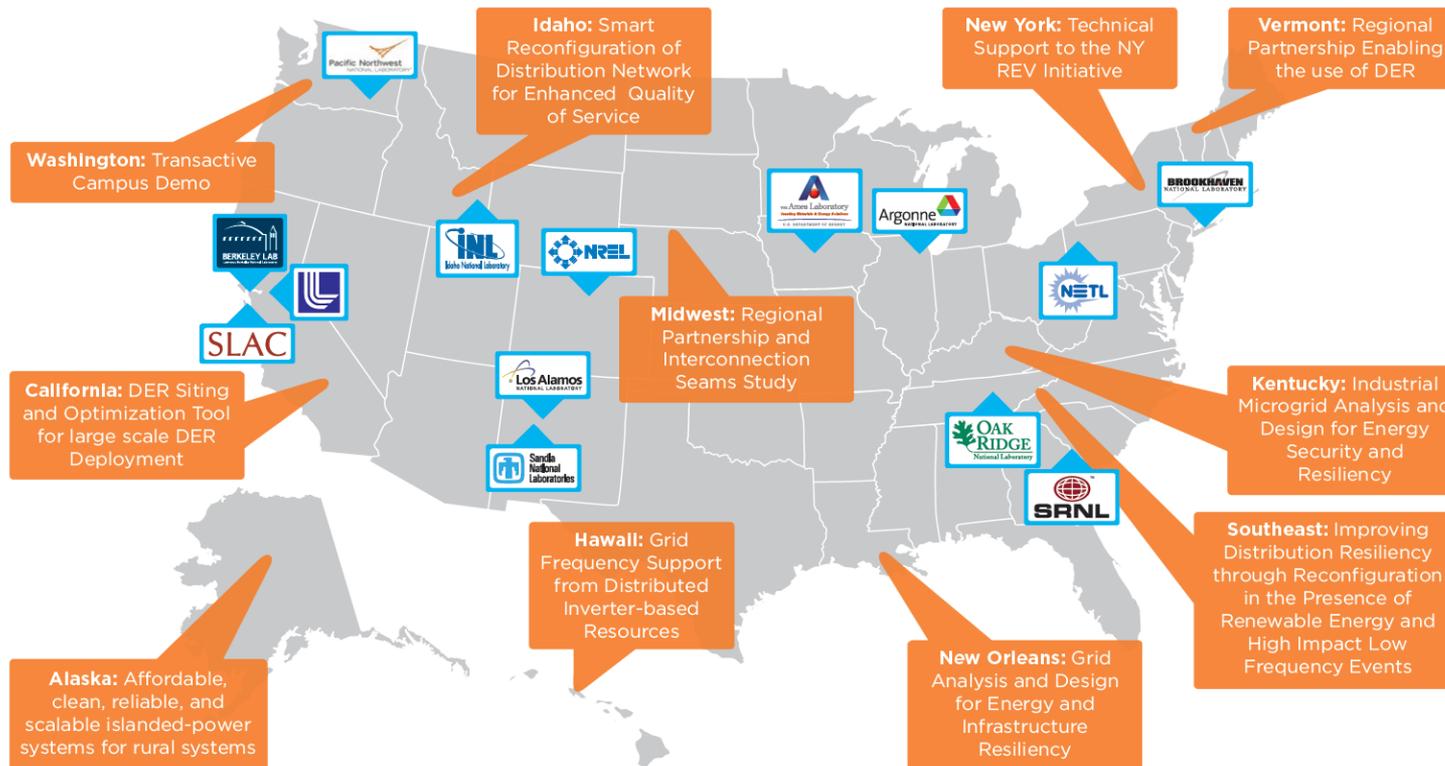
- ▶ Overview of GMI
- ▶ Overview of the Grid Modernization Lab Call
- ▶ Results from the Grid Modernization Peer Review
 - Design and Planning: Interconnection Seams Study
 - System Operations, Power Flow, and Control: Grid Architecture
 - Sensing and Measurement: Integrated Multi-Scale Data Analytics and Machine Learning
 - Devices and Systems Integration: Interoperability
 - Security and Resilience: Infrastructure Resilience for New Orleans
 - Institutional Support: Future Electricity Utility Regulation

Grid Modernization Multi-Year Program Plan



Grid Modernization Lab Call

Working across the country



- Up to \$220M
- 13 national laboratories

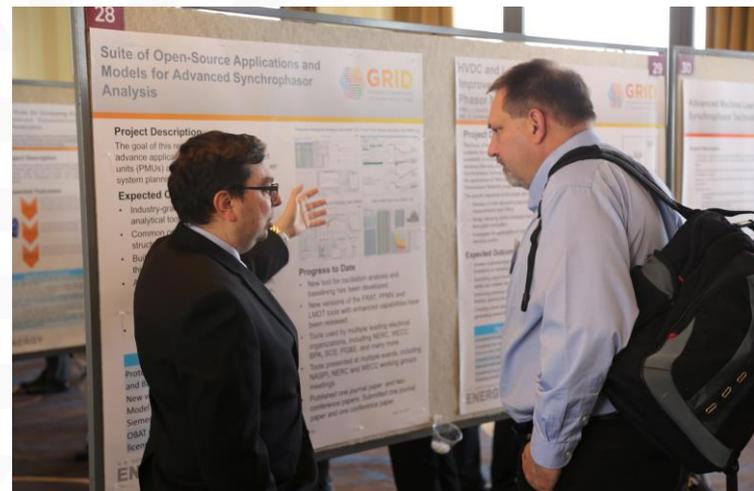
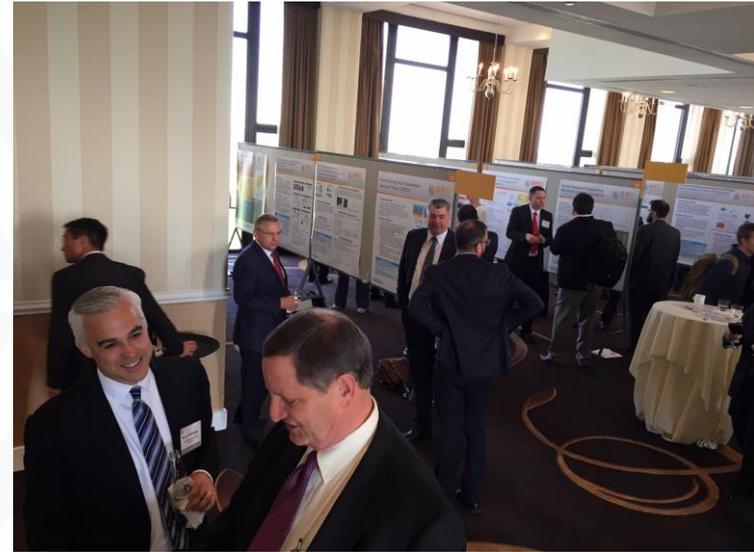
- 88 projects
- 150+ partners

A Sample of our Project Partners



Grid Modernization Peer Review

April 18th – 21st (Washington, D.C.)



Design and Planning Tools

Reviewer Findings



Design and Planning Tools

- Create grid planning tools that integrate transmission and distribution and system dynamics over a variety of time and spatial scales

- ▶ **Software:** Encourage open source software whenever possible
- ▶ **Data Requirements:** Need for an open repository to handle data and make it accessible; work with ARPA-E GRID DATA program
- ▶ **Connections to Industry:** Need to create an easier transition to enable existing vendors to adopt these new software platforms being developed
- ▶ **Connections to Utilities:** 3000 utilities with different needs and capabilities; must make adoption as simple as possible for utilities
- ▶ Government (DOE/FERC/NERC) should be more involved and have **more robust planning criteria and standards.**

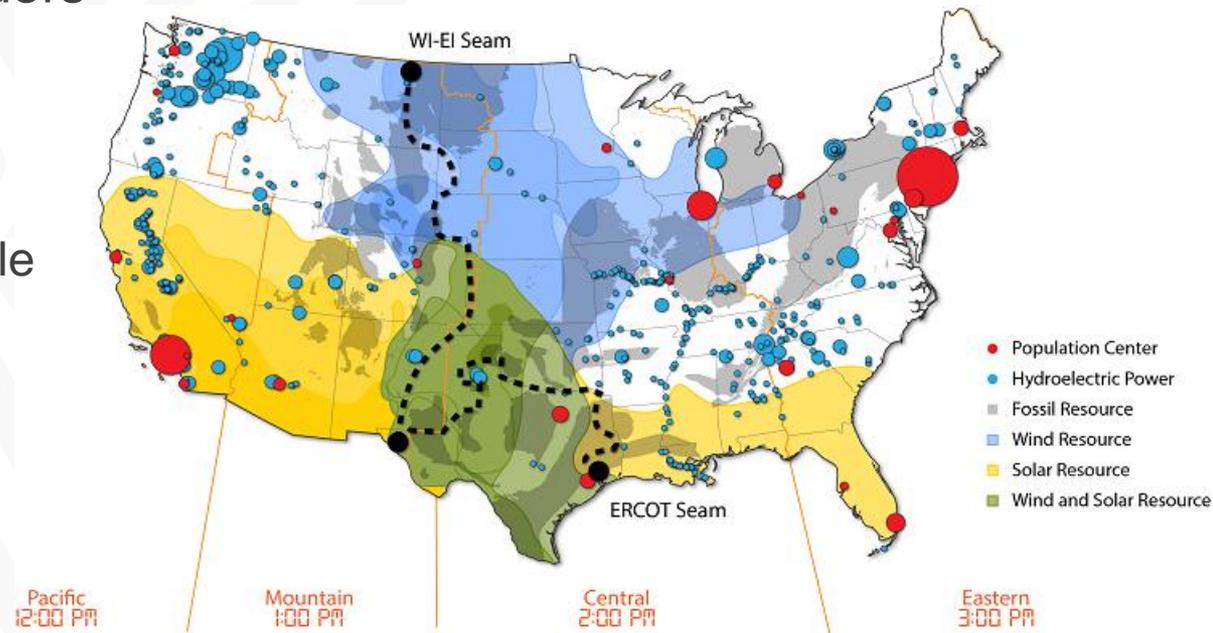
INTERCONNECTION SEAMS STUDY

Design and Planning Tools



- ▶ Wide-area study of the reliability and efficiency of 4 transmission futures.
- ▶ Leverages state-of-the-art data, HPC, and stakeholders across the country.
- ▶ Great synergy to other projects:
 - North American Renewable Integration Study
 - Production Cost Modeling

- ▶ Partnerships with MISO, SPP, WAPA. SPP and MISO interested in doing further work.

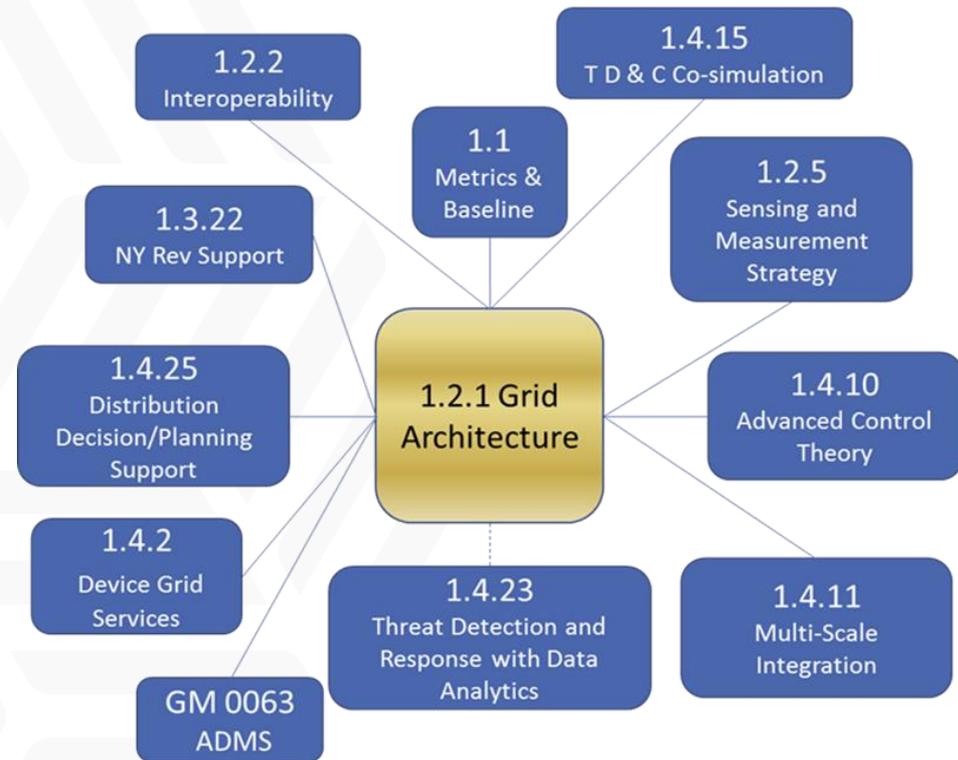


System Operations, Power Flow, and Control

- Design and implement a new grid architecture that coordinates and controls millions of devices and integrates with energy management systems

- ▶ **GMI Portfolio** in System Operations looks very good
- ▶ **Grid MYPP**: Two areas in system operation not covered by the projects presented
 - *Analytics and computation* for grid operation and control (very important)
 - *Power Flow* is not as great a priority
- ▶ Consider funding **fewer projects** that are larger in scale
- ▶ Work in **Grid Architecture** is really important
 - Integration with the extended grid state is really important
 - Need to make the material more accessible
- ▶ **Challenges**
 - Transactive can be more complicated than simplifying
 - Need to communicate the results of the work out more broadly
 - Make sure to keep up with the progress by industry in these areas

- ▶ Working on the application of system architecture, network theory, and related disciplines to the entire grid.
- ▶ Principles and guidelines to grid architecture with scenarios, prioritization, and reference models
- ▶ Stakeholder driven: common shared terms with EPRI, SGIP, and others



Sensing and Measurement Reviewer Findings

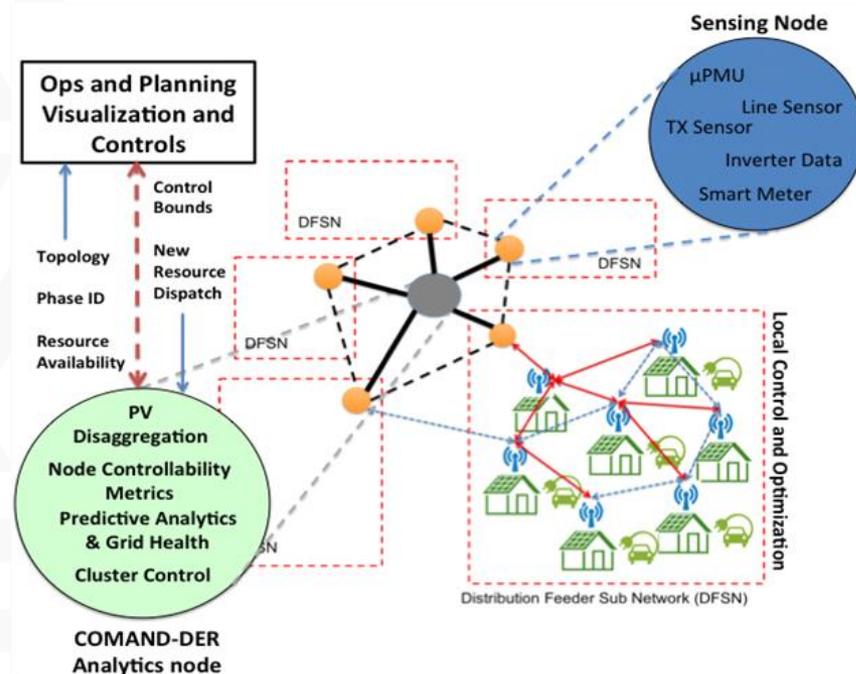


Sensing and Measurements

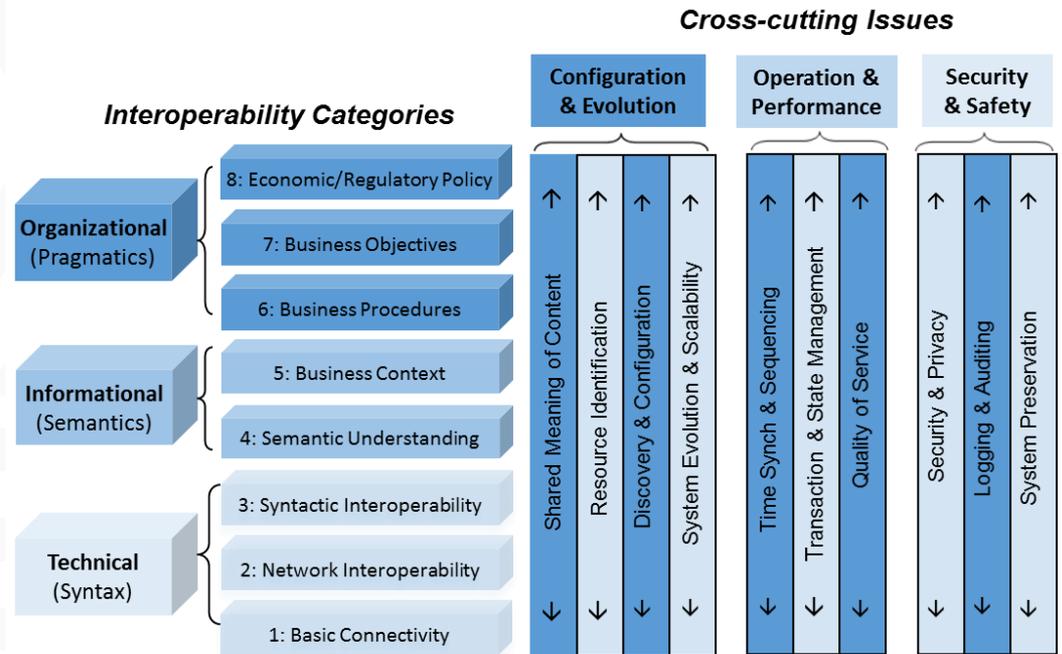
- Incorporates information and communications technologies and advances low-cost sensors, analytics, and visualizations that enable 100% observability

- ▶ **Communication element of the MYPP** not so evident in any of these projects
- ▶ **Poor data quality** may lead to great applications, development, and analysis based on poor data – What is DOE’s role in data quality?
- ▶ **Sensor placement** effort should consider both optimal and practical sensor locations
- ▶ **Sensor development** work needed more context on why those particular sensors were prioritized
- ▶ **Machine learning** project’s focus on high-priority use cases was excellent

- ▶ Develop and demonstrate distributed analytics solutions to building-grid challenges, leveraging multi-scale data sets, from both sides of the meter.
- ▶ Evaluate and demonstrate the application of machine learning to create actionable information for grid and building operators.
- ▶ Enable the transition from data to actionable information at the building to grid interface.



- ▶ Advance adoption of interoperable products and services in the energy sector.
- ▶ Reduction of cost and effort for system integration; improved performance, efficiency, and security.
- ▶ Facilitate gap analysis, develop roadmaps, and demonstrate vision concepts.



Devices and Integrated Systems

- Develop new devices to increase grid services and utilization and validate high levels of DER at multiple scales

- ▶ **No Foundational Investments in Power Electronics and Energy Storage** – should investments in these technologies be more coordinated across the Department?
- ▶ **Laboratory Testing Network:** More focus on the open library and less on the laboratory network.
- ▶ Need more **engagement from industry** on standards and testing work.
- ▶ Concentrate on **early-stage** R&D and look to incorporate existing work.

Security and Resilience

- Develop resilient and advanced security (cyber and physical) solutions and real-time incident response capabilities for emerging technologies and systems

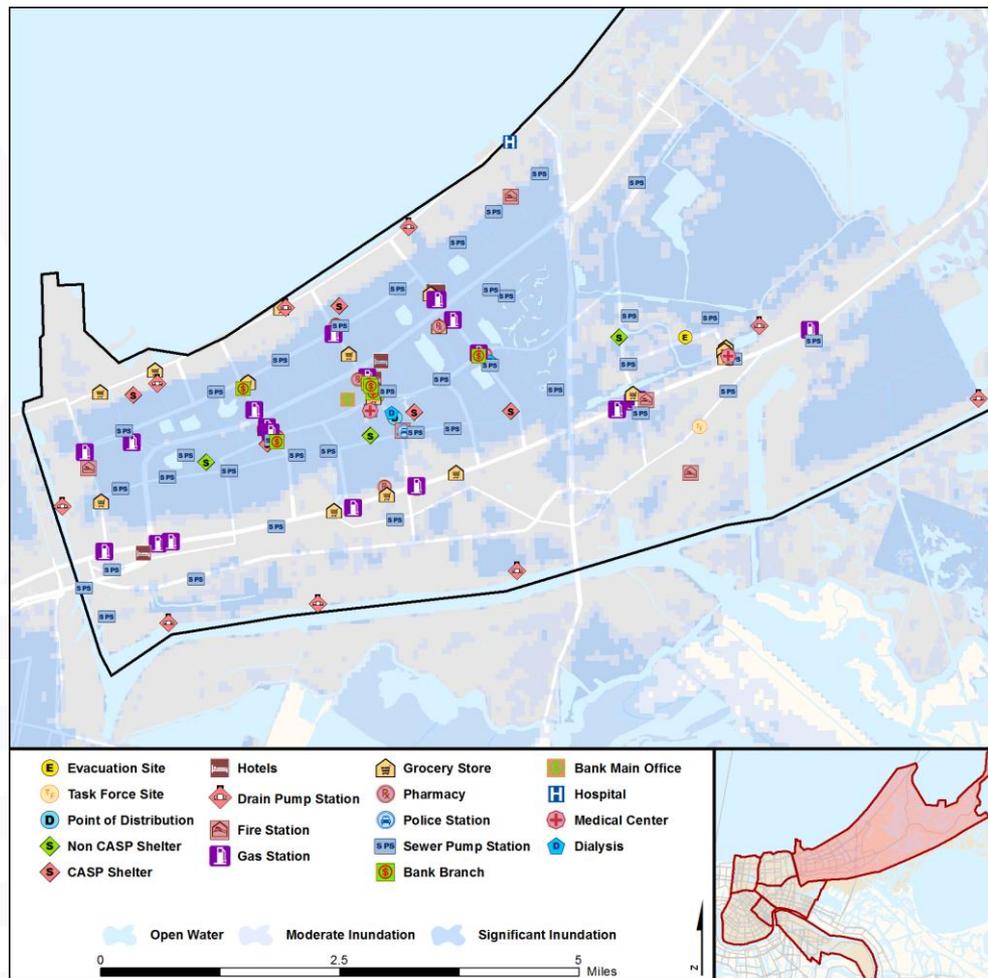
- ▶ **Not enough coverage** of this area enough in the GMLC.
- ▶ Security needs to be **incorporated into everyone's efforts** in a holistic way.
- ▶ **Strong interoperability standards** can do a lot to ensure systems are secure - making sure that devices **ONLY** respond to the right queries and **NOTHING ELSE**.
- ▶ **More diversity** in the partnerships (just UPS and NOLA) – What are the lessons learned from these projects that apply nationally?
- ▶ Getting **people trained** in cyber is important.

INFRASTRUCTURE RESILIENCE IN NOLA

Security and Resilience



- ▶ Focused on enhancing grid resilience in order to improve overall community resilience. Reduction of cost and effort for system integration; improved performance, efficiency, and security.
- ▶ Project show how investments in the grid, namely *microgrids*, improve community resilience, and how these investments can be prioritized.



Institutional Support

- Develop resilient and advanced security (cyber and physical) solutions and real-time incident response capabilities for emerging technologies and systems

- ▶ **Good Projects** moving in the right direction
- ▶ **Metrics project** is difficult but important area for DOE to support
- ▶ **More feedback** from the States, consumer advocates, and other stakeholders on these projects would be beneficial
- ▶ **Communications:** Results need to be communicated more broadly
- ▶ **Valuation Framework** received good feedback by the peer review committee
- ▶ **Capture** all lessons learned from projects so information can help other states and entities.
- ▶ Work on **Train-the-Trainer** – states mentoring other states.

- ▶ Provide technical assistance and analysis for public utility commissions (PUCs) and a series of reports with multiple perspectives on evolving utility regulation and ratemaking, utility business models and electricity markets:
 - Adapting to new technologies and services
 - Assessing potential financial impacts on utility shareholders and customers
 - Engaging consumers
 - Addressing utility incentives to achieve grid modernization goals

- ▶ Reports:
 - *The Future of Centrally-Organized Wholesale Electricity Markets* (March 2017)
 - *Regulatory Incentives for Utilities to Invest in Grid Modernization* (under peer review)
 - *Value-Added Electricity Services: New Roles for Utilities and Third Parties* (underway)

Post Peer Review: Lessons Learned



- ▶ Communicate! Many experts are interested in this work but just do not know about it.
- ▶ Check-in with industry to see if work is relevant to their future roadmap.
- ▶ Abstract work needs to be clarified upfront to help set expectations.
- ▶ Some projects will be re-scoped: narrow focus to early-stage R&D to make biggest impact.
- ▶ Need to work of a broader cybersecurity plan not only for DOE, but also integrate into the developing plans across the federal government.
- ▶ Pioneer Partnership Projects sunsetting
 - Working on disseminating experience and findings so that others can derive benefit on all the projects.
 - Looking to possibly expand future work for a few projects that were reviewed well.

Thank You



Contact us at gmi@hq.doe.gov
Visit us at <https://energy.gov/gmi>